REVIEW ARTICLE

# Review of Venous Anatomy for Venographic Interpretation in Chronic Cerebrospinal Venous Insufficiency

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## ABSTRACT

Chronic cerebrospinal venous insufficiency (CCSVI) represents a recently described condition that may potentially contribute to the symptoms experienced by patients with multiple sclerosis. The evaluation of a prospective patient for CCSVI often involves an invasive evaluation with venography of the internal jugular and azygos veins. The purpose of this article is to review the normal anatomy of the internal jugular, vertebral, and azygos veins, as an understanding of these veins is necessary for appropriate interpretation of the venograms obtained to evaluate patients for CCSVI.


## ABBREVIATIONS

AJV = anterior jugular vein, AP = anteroposterior, CCSVI = chronic cerebrospinal venous insufficiency, EJV = external jugular vein, IJV = internal jugular vein, LAO = left anterior oblique, RAO = right anterior oblique, SVC = superior vena cava

Chronic cerebrospinal venous insufficiency (CCSVI) represents a recently described condition that may potentially contribute to the symptoms experienced by patients with multiple sclerosis (1). The evaluation of a prospective patient for CCSVI and possible treatment with venous angioplasty involves a noninvasive evaluation with Doppler ultrasound (US) and/or magnetic resonance venography and an invasive evaluation with selective catheterization and venography of the internal jugular and azygos veins (2,3). Although interventionalists have significant experience with venous access and catheter placement in the internal jugular vein (IJV), the indications for, and therefore the experience with, selective catheterization and venography of the internal jugular and azygos veins are limited. The purpose of this article is to review the normal and variant venous anatomy of the head, neck, and azygos systems. As the efficacy of venography and angioplasty is unproven in the evaluation and treatment of multiple sclerosis, a thorough understanding of this anatomy is essential in the safe pursuit of this important research.

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None of the authors have identified a conflict of interest.



*J Vasc Interv Radiol 2011; 22:1681–1690*

DOI: 10.1016/j.jvir.2011.08.018

## INTERNAL JUGULAR VEIN

The IJV is the dominant outflow vein from the brain, beginning as the continuation of the transverse and sigmoid sinuses in the jugular foramen. The superior bulb of the IJV, which is an area of mild venous dilation, is located in the jugular foramen. Immediately below the jugular foramen, it is common for the posterior wall of the vein to rest against the anterior surface of the transverse process of C1 (4). In some patients, the transverse process can indent or kink the posterior wall of the IJV (**Fig 1**), possibly causing an increase in intracranial venous pressure if it occurs on the side of the dominant transverse and sigmoid sinus (4). Below the transverse process of C1, the IJV runs lateral and slightly anterior to the internal carotid artery, typically within 1 mm of the artery (5). This may result in compression along the medial aspect of the IJV proximal to the carotid bifurcation (**Fig 2**). The vein then passes below the sternocleidomastoid muscle to join the subclavian vein (6). Anomalies of the IJV are rare. Duplication of the IJV has been reported and is estimated to occur in approximately four per 1,000 unilateral neck dissections (7,8).

Valves are known to be present in the IJVs (9). In autopsy studies, valves were seen in 86%–93% of veins


**Figure 1.** **(a)** Lateral view from a left IJV venogram with inward bowing of the posterior aspect of the vein by the transverse process of C1 (*C1*). **(b)** Single image from a CT angiogram demonstrates bilateral posterior IJV compression anterior to the transverse process of C1.

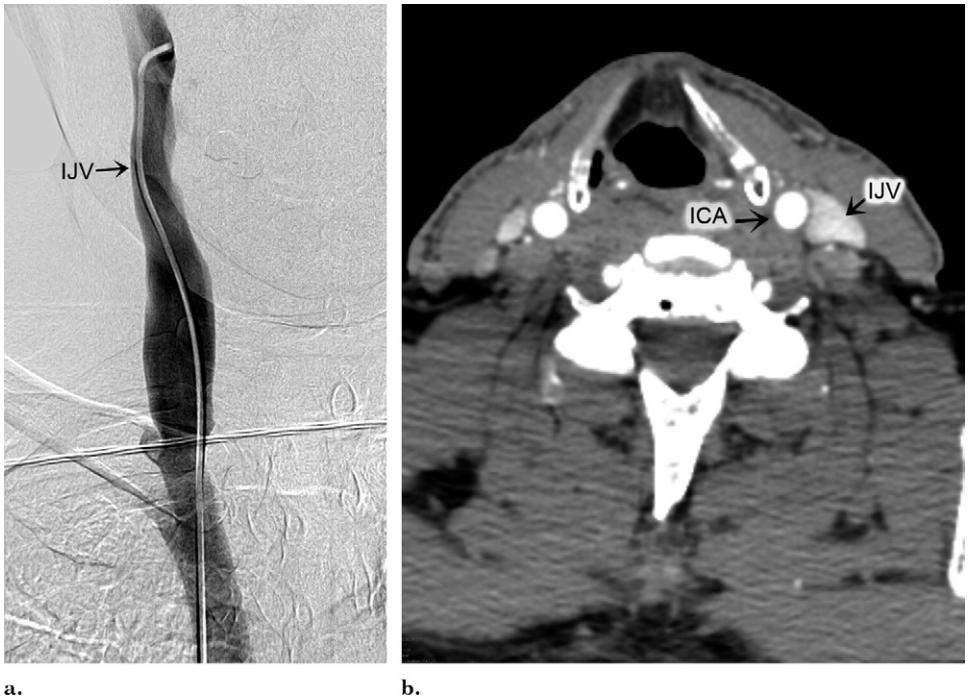


**Figure 2.** **(a)** Right anterior oblique (RAO) view from a right IJV venogram with luminal narrowing of the IJV secondary to medial compression from the common carotid artery. **(b)** Single image from a CT angiogram demonstrates medial IJV compression by the internal carotid artery (*ICA*).

(10–12), whereas, in US screening studies, a valve was found in one or both of the IJVs in 72%–96% of patients (12–14). In patients with a valve on only one side, 80% are located on the right side (12). The cusps of the IJV valve are thin, translucent structures (15). Most of the valves are bicuspid with anterior and posterior leaflets, although uni-